which the experience of this company has shown to be advantageous from a financial as well as a humanitarian stand-point.

Dr. Dana discussed the relation of high altitudes to nervous diseases. He had investigated the subject by means of questions addressed to physicians in various elevated stations, and arrived at the following conclusions: choreiform manifestations are increased by high altitudes; nervousness and irritability are also increased; nervous women especially are rendered more nervous; the weight of opinion seems to be that old age is not prolonged by altitude; epilepsy is not increased, sometimes the patients improve; insomnia is usually benefited, often cured; the gouty diathesis is not helped by the change.

The officers for the coming year are, president, Dr. Frank Donaldson of Baltimore; 1st vice-president, Dr. V. I. Bowditch of Boston; 2d vice-president, Dr. R. G. Curtin of Philadelphia; secretary, Dr. J. R. Walker of Philadelphia.

PROGRAMME OF THE INTERNATIONAL PHILOMATHIC CONGRESS.

THE International philomathic congress, having for its object the discussion of commercial and industrial technical instruction, and opening Sept. 20, 1886, has arranged the following programme of questions for discussion: I. General questions: Present condition of commercial and industrial technical instruction in France and abroad; domain of this instruction; importance due it; its influence on the economic, commercial, and industrial condition of the country; general view of an organization of technical instruction; preparation for the various branches of this instruction; action of the state, general councils, municipalities, chambers of commerce, consulting chambers, syndic chambers, and private corporations; on the establishment of schools of technical instruction; on the elaboration of their methods and courses of instruction; on their government; on their financial organization; to what extent should technical instruction be provided with a general and uniform course? to what extent should it have special courses appropriate to the necessities of each district? what position should be allotted in the different schools of technical instruction to general instruction? what proportion is to be allotted to theoretical and what to practical instruction? relations among themselves of similar schools of technical instruction, with a view to common action respecting all general measures intended to aid their development, and assure their prosperity; concerning their representation in the superior council of technical instruction; periodicity of the congress for technical instruction; place and state of the next congress. II. Special questions: organization of commercial technical instruction, first degree (elementary commercial instruction), second degree (more advanced commercial schools), advanced degree (advanced commercial studies); organization of industrial technical instruction, first degree (workmen), second degree (master workmen and foremen), advanced degree (engineers); preparation and admission of the pupils; instruction by the master workmen; apprenticeship; schools; laws and regulations, courses, and methods; theoretical instruction and practical instruction; instruction in drawing; manual labor; staff of administration and instruction; councils of administration and improvement; buildings and material; plans and distribution of the buildings; instruments and material for instruction; libraries; commercial museums: industrial museums; financial organization; fellowships; scholastic excursions and expeditions; travelling fellowships and resident fellowships abroad; finding places for pupils after graduation; places and salaries; complimentary courses of technical instruction; courses for apprentices and adults; public lecturers. All information relating to the congress may be had of the general secretary of the Philomathic society at Bordeaux, Eugene Buhan.

NOTES AND NEWS.

WE have received a pamphlet of fifty-one pages on the Pennsylvania boroughs, which may interest some of our readers. It is written by William P. Holcomb, and forms one of the studies in historical and political science published by the Johns Hopkins university, the fourth series of which is now under way. The author begins with an account of the introduction of the borough system under William Penn, and then sketches the history of some of the leading boroughs, and concludes with a description of the borough system as it now exists. This method of local government is only found in three American states, — Pennsylvania, New Jersey, and Connecticut, — and citizens of other states have some difficulty in understanding what a borough is, and wherein it differs from a city. According to Mr. Holcomb, the difference is mainly one of size, ten thousand inhabitants being required, under Pennsylvania laws, to constitute a city, while a borough need not have more than a few hundred. Then a city in that state has two representative councils, while a borough has only one; and these two points, with a few differences in names, seem to be the only distinction between the two kinds of

municipalities. The author expresses some surprise that boroughs, which are so common in England, should be so rare in the United States; but, if they differ so little from cities, there would seem to be no particular need of them. Mr. Holcomb's work will doubtless be useful to Pennsylvanians and to students of municipal government generally.

— The U. S. coast survey has issued a new edition of the chart of Humboldt Bay, made from the most recent surveys; the third edition of appendices 12 and 13 of the report of 1882, on magnetic declination, by assistant Schott; the latest chart showing the entrance to New York harbor; and the tenth sheet of the District of Columbia map, made under the direction of the Corps of engineers by Assistant Doun. A new chart of St. John's River, Florida, from its mouth to Jacksonville, is in course of preparation. The New York bay entrance sheet, 8 A, is now ready for distribution to dealers.

— The Boston medical-school circles are at present agitated over the question whether the female medical students shall be allowed to attend the general surgical clinics in the city hospital, they having insisted upon that privilege by attending, and refusing to withdraw.

— The German secretary of state has published statistics on the periodicals of the world, from which it appears that there are 34,000, with a distribution of 592,000,000 copies; 19,000 are published in Europe, 12,000 in North America, 775 in Asia, 809 in South America; 16,500 are in English, 7,800 in German, 3,850 in French, and 1,000 in Spanish.

— MM. H. Fal and E. Sarasin, in a recent communication to the French academy of sciences, have supplemented their researches on the penetrability of light in deep water by the results of a series of observations in the Gulf of Nice, showing the relation that exists between the vertical and oblique rays of the sun in their power to reach to great depths. They found the limit of luminosity to be four hundred metres in mid-day of April, and that only for a short time. At eight o'clock in the morning its penetrability was limited by three hundred and fifty fathoms; at six o'clock in the afternoon the light reached less than three hundred metres.

— For a number of years past the city of Liverpool has been engaged, at much cost and trouble, in the perfection of her sewerage and house-drainage systems. The works are only just completed, but already very distinct results are evident in their influence upon the city's mortality. For the ten years prior to 1870 the death-rate per thousand of the inhabitants was no less than 32.5; between 1870 and 1880 the mortality had fallen to 28.4; and since then a steady and uninterrupted fall has been maintained, until, during 1885, it only reached 23.5.

— It is stated in the daily papers that Prof. J. Emerick of William and Mary college has discovered the aerolite which fell in Washington county, Penn., on Sept. 14, 1885. It was found embedded deep in the soil near Claysville, and is said to weigh fully two hundred tons, — a statement that needs confirmation.

— The members of the Chesapeake zoölogical laboratory of Johns Hopkins university left Baltimore on Thursday, the 20th of May, for Abaco, one of the islands of the Bahama group, where the summer session of the laboratory will be held. The party consists of Prof. W. C. Brooks (the director), Professor Mill, Dr. H. Orr, Messrs. E. A. Andrews, F. H. Herrick, H. V. Wilson, and two or three other students of Johns Hopkins.

— A favorable report has been made by the house committee on agriculture on the bill to amend the act creating a bureau of animal industry. The most important change is in section 1 of the present law, which is to be entirely repealed. The substitute offered proposes that the chief of this bureau shall be a competent veterinary surgeon, who is to investigate the condition of the domestic animals in this country, and inquire into the causes of contagious, infectious, and communicable diseases among them, and the means for the prevention and cure of the same. The bureau is further instructed to make special investigations of pleuro-pneumonia, foot and mouth diseases, and rinderpest in cattle. Two hundred and fifty thousand dollars are to be appropriated to carry into effect the provisions of the act.

— The first shipment of shad to the Pacific coast by the U. S. fish commission has resulted most successfully. Car No. 1, which left Washington last week in charge of Mr. J. F. Ellis, with a million young shad, arrived at Portland, Ore., with seven hundred thousand. This experiment of transporting shad so great a distance proves the practicability of shipping them in this way. Of greater interest to science, however, was the successful experiment of hatching the shad *en route*. Six hundred thousand eggs formed a portion of this western shipment, which were placed in four MacDonald jars. A pump was kept continually at work, moving the water, and fully ninety-five per cent of the eggs were hatched. Of the five per cent lost, most of them were due to premature

hatching. This is a most gratifying showing for the fish commission, which is constantly discovering and applying new methods in the science of fish-culture.

— The following comprise the recent changes in the coast survey service. Parties on the Pacific coast have all taken the field under instructions. Professor Davidson is at Portland, Ore., observing for telegraphic longitude, while Assistant Pratt is at Tatoosh Island, which point is made available as a telegraphic longitude station, from the fact that the U. S. signal service now has wires in operation from Port Angeles to that point. Assistant Whiting takes the field about June 1 in Massachusetts, to determine the changes at Cotamay, Martha's Vineyard. Assistants Smith and St. Clair are between Colorado Springs and Salt Lake City, engaged in telegraphic longitude determination. Parties in the south will shortly be closing their season's work, and will report to the Washington office for future field-duty. The geographical positions of the Borden survey of the state of Massachusetts, together with a great number of additional points determined by the coast and geodetic survey, computed upon Clark's spheroid, are ready for publication in the annual report for 1885.

— A report just received from the U. S. consul at Apia gives the following as the copy of a card found inside a bottle picked up on Palmyra Island, Nov. 26. 1885: "R. M. Str. Zealandia from San Francisco to Sydney, Lat. 7° 30′ N.; Long. 163° 30′ W." This bottle had drifted a hundred and one miles south by east.

— In Holland, where the public-school system has reached a very highly developed stage, it is now proposed to relegate primary education to the private schools. A measure to that effect has passed the lower chamber of the states-general, and has been withdrawn by the government for the purpose of removing certain objectionable features which caused its rejection by the upper house.

— The coldest place upon the earth, says *Ausland*, is Verchojansk, in Siberia. The coldest regions of Asia lie east of the Lena River, and the meteorological station at Yakootsk has recorded the lowest temperature ever observed. The average temperature for the year at that place is −17° C., and the difference between the summer and winter temperatures is not less than 64° C.; the average temperature in January being −49° C., and in July, +15° C. On Jan. 15, 1885, the temperature fell to −68° C.

— Recently published statistics of British India give the entire population (for 1883–84) at 253,982,595, and the superficial area at 1,378,044 square miles. 43,549,158 residences were enumerated. The density of the population reaches its maximum in Bengal, where there are 442.8 inhabitants to each square mile: the minimum is found in Central India with 59.3, and in British Burmah with 42.8, to each square mile. For every 130 males there are 124 females. The Hindoos and Buddhists include 190,000,000; the Mohammedans, 50,000,000; Christians, 1,800,000; Parsees, 85,000; Jews, 12,000; and various other sects with smaller numbers. The entire debt of India amounts to £171,577,945. In March, 1885, the entire length of railroads, in miles, was 12,000; of the telegraph systems, 23,341; the total length of wires, 68,694.

— A canal between the White Sea and the Baltic Sea has been determined upon by the Russian authorities, says *Ausland*. Peter the Great long ago busied himself with such a project, which only lately was revived by the Russian society for the promotion of commerce and industry. The cost, which is estimated at seven million rubles, will be borne by the state. Work will be begun upon the canal the present year.

— Statistics of the French sea-fisheries, for 1884, recently published, give the total value of the catch for that year at 87,961,124 francs, — a decrease from that of the previous year of 19,265,797 francs.

— Dr. Valentine Mott, who went to Paris some months ago to study Pasteur's methods of hydrophobia treatment, has just returned, very sanguine in his belief of its efficacy. He brought with him, on his return, a rabbit inoculated by Pasteur just before his departure. The rabbit died on the seventh day after receiving the virus, a short time before coming into port. This is said to be the first time that Pasteur has given the virus to any one, and it will be utilized for further propagation and hydrophobia treatment by Dr. Mott.

— One of the oldest medical colleges, if not the oldest, in the world, is the Medical school of the Imperial university of Japan, which now numbers its centuries by two figures. In its earlier period its faculty included a superintendent and assistant, one professor of medicine, one of acupuncture, one of massage, and various other instructors in special diseases, materia medica, botany, etc. The course then covered seven years, and even now the school shows a more creditable status than the most of ours. Four years in actual medical studies are now required, with three years' preparation, — in all, seven years of college training. We wonder whether the profession in

America would be crowded as badly as the universal lamentations of medical men indicate, if all were excluded from practice, save those who had spent seven years in preparation. The course of instruction at the Japanese college is modelled after that of the German schools, and the lectures are mostly delivered in the German language, by the five foreign professors, though there is a special course in the Japanese. The total number of students in attendance last year was nine hundred and seventy-two.

— Messrs. W. T. Jackman and J. D. Webster have lately succeeded in obtaining good photographs of the retina of the living human eye, illustrations of which are given in the English *Photographic news*. They were able to bring the time of exposure for the negative to within two minutes and a half, and it is very probable that technical skill will further reduce the time and difficulties. The chief obstacles to shortening the time of exposure, so far encountered, are the color of the retinal reflection, and the fact that the lens of the eye has the property of absorbing the ultra-violet rays. It seems highly probable that the photograph will here become a valuable adjunct to the physiologist, ophthalmologist, or even the general physician, as the eye affords diagnostic aid in not a few diseases.

— C. Wiegelt, O. Sacre, and L. Schwab have made a series of very valuable experiments, says the *Chemical news*, on the injury to fisheries and fish-culture by sewage and industrial waste waters. They find that chloride of lime, in proportions of 0.04 to 0.005 per cent chlorine, has an immediate deadly action upon tench, while trout and salmon perish in presence of 0.0008 per cent of chlorine. Sulphurous acid has the same action as chlorine, and is still more hurtful if another acid is simultaneously present; sulphites are harmless. Hydrochloric acid, 1 per cent, kills tench and trout. In sulphuric acid of 0.1 per cent, trout turn on their sides in two to six hours, while tench were not affected in eighteen hours. Acids are said to have less action, the higher are their molecular weights. Tannin at 0.1 per cent is harmless. Ammonia exerts no action at 0.01 per cent. Soda at 1 per cent is fatal to trout on prolonged exposure. Manganese chloride at 5 per cent had no action on tench in twenty-two hours, and a trout sustained 1 per cent for five hours. Iron acts as a specific poison upon fishes, except in the state of a ferrous salt. Alum has the same injurious action as the salts of iron. Solution of caustic lime has an exceedingly violent action upon fishes, due in part to the deposition of calcium carbonate in the gills. Arsenious acid, 0.1 per cent, combined with soda, has no injurious action upon trout and tench. Mercuric chloride, in proportions of 0.1 and 0.05 per cent, is immediately fatal. Copper sulphate, 0.1 and 1.0 per cent, kills trout in a few minutes if they cannot escape into pure water. Potassium cyanide, 0.01 and 0.005 per cent, is rapidly fatal if there is no escape. Potassium sulphocyanide and ferrocyanide, in the proportion of 1 per cent, had no injurious action in an hour. Sodium sulphide, 0.1 per cent, was endured by tench for thirty minutes. The fish were bleached, and did not recover their color in pure water. Hydrogen sulphide proved rapidly fatal in the proportions of 0.01 and 0.001 per cent. The hurtfulness of putrid sewage depends on poisonous gases, on the deficiency of oxygen, and on the action of bacteria.

— The death is announced of Mr. Thomas Edwards, the Scotch shoemaker naturalist whom Dr. Smiles made famous.

— In an article on coal-consumption as affected by temperature and length of trains, the *Railroad gazette* reaches some interesting conclusions. Dead weight to the amount of thirty tons added to a train of, say, five cars, will not increase coal-consumption as much as to add another car, both because it does not increase air-resistance and because the added load decreases somewhat the rolling resistance per ton. If we assume it to add five pounds per mile to the coal-consumption, we are certainly not underestimating it proportionally. Adding six tons per car, therefore, to the average weight of a train of five passenger-cars, means no more than an increase from fifty-five to sixty pounds per train-mile. If we assume this five pounds of coal to be worth one cent (at the rate of four dollars per ton of two thousand pounds for coal), and if an extra passenger at three cents per mile be attracted to the train every third trip, he will pay for the loss of fuel due to adding six tons to the weight of every passenger-car, which goes a little way toward explaining the tendency to increase weight for the sake of luxury, which seems so reckless. In this estimate, the effect of extra weight on grade-resistance is taken into account, though in reality it is comparatively unimportant. It is estimated that about six pounds and a half of coal per mile are added to the consumption for each passenger-car of twenty tons or more moved at way-train speed, and for each sleeping-car of thirty tons or more moved in through trains making few stops, and that the locomotive alone is to be charged with rather more coal than that due to three cars.

— The discovery of an interesting illusory effect in the sense of sight is given by Professor Exner

in the *Biologisches centralblatt*. His attention was directed to the subject by a simple incident. Lying upon the floor of a hut near an open fire, he noticed that the sky, as seen through a small window, seemed frequently lit up, as though by lightning. Assuring himself that such was not the case, he found that the apparent phenomenon was due to a deception caused by the flickering light in the room, though no changes in its intensity were visible. To show the effect more strongly, he constructed a translucent shade before a lamp, upon which he attached a small disk of thick white paper. This lamp was so arranged that its brightness might be quickly and easily varied. On the other side a gas-lamp enclosed by an opaque cylinder was placed, emitting a ray of light through a lens directly upon the paper disk. Looking now at the disk through a hollow cylinder at a distance of several feet, while the light behind the shade was made to vary in intensity, there was found a striking effect, in that the variation appeared to rest only in the paper disk, while the surrounding field appeared constant. This illusion, the author says, shows that we are inclined to hold as constant the predominating brightness in the field of vision, and attribute variation to the subordinate.

— It has been experimentally proved by the English commission on accidents in mines, as stated in their last report. that a percentage of marsh-gas amounting to five per cent, or even four per cent, of atmospheric air, is decidedly explosive. Half of this proportion, however, though not in itself dangerous, and though impossible of detection by ordinary lamp-tests, will explode if the air be laden even lightly with fine, dry coal-dust ; and it is probable that some of the obscure causes of accidents may be ascribed to this cause. The opinion of the commissioners with regard to the older Davy, Clauny, or even Stephenson lamps, is that they have in a great measure lost their value in consequence of the draughts of air from the free ventilation. A current of air of eight hundred feet per minute in an impure atmosphere may, in spite of the wire gauze, effect an explosion in any one of them. Electric lighting is already to some extent in use ; and as the risk from its use is much less, and its lighting-power greater, it probably will be more generally adopted.

— The summary report of the operations of the geological and natural history survey of the Dominion of Canada by the director, A. R. C. Selwyn, gives a creditable showing for the amount of money expended. Work, chiefly geological and topographical, has been prosecuted over portions of every province and territory in the dominion, from Nova Scotia to the west coast of Vancouver Island. The *personnel* of the survey is now composed of a staff of fifty employees, — thirty-four professional, and sixteen ordinary. The expenditure amounted to something over ninety thousand dollars during the past year. The topographical results will be embodied in a number of maps now in process of preparation. These maps include one of British Columbia, that will shortly be published ; one of Assiniboia, now in the hands of the engraver ; and one of the Bow and Saskatchewan rivers, on a scale of eight miles to the inch, well advanced. Another on Manitoba and western Ontario, to cover 3,456 square miles, and a very important geological map of the peninsular portion of Ontario, to be issued in sheets of uniform size, are in progress, as well as maps of Quebec, the Lake of Mistassini and adjacent regions, and portions of Nova Scotia and New Brunswick. Much less attention is paid to biology, with the exception of paleontology ; yet in botany and zoölogy considerable progress has been made. Among the more interesting results of the explorations is the determination of the size of Lake Mistassini, about which there has been great uncertainty. It was found to be about one hundred miles in length, with an average breadth of about twelve miles, — a very different figure from what is represented on the maps.

— Dr. Alfred Goldscheider, says the *Lancet*, has recently published the results of researches he has made upon the nerves, by which sensations of temperature and pressure are conducted. He finds that the skin is not in all parts capable of perceiving variation of temperature, and that some parts can only recognize sensations of cold, other parts only sensations of heat. These, which he terms warm and cold points, are distributed between or among each other, but never coincide. Their general arrangement is, that they are disposed in chains which pursue a slightly curved course. These chains radiate from certain points, which may be termed radiation-points or temperature-centres. The chains of the cold-points do not in general coincide with those of the heat-points, but these radiation-points are identical. The cold-points are in all parts of the skin more numerous than the warm-points. When the cold-points are excited by either mechanical or electrical stimuli, a punctiform sensation of cold is experienced, and the opposite sensation is felt when the warm-points are stimulated. Goldscheider was able, by stimulation of nerve-trunks, to excite eccentric sensations of heat and cold. The temperature-points were found to be insensitive

to pricks and other punctiform pain-excitants. Goldscheider admits, therefore, not only the existence of nerves exclusively devoted to perceptions of temperature, but specific nerves for heat and cold. The sensibility of the surface of the body to temperature presents great topical variations, and is directly dependent in any region upon the number and intensity of the temperature-points, — that is to say, upon the local wealth of temperature-nerves, — and go hand in hand with the distribution of the great nerve-trunks. Goldscheider also differentiates in the skin nerves of general sensation and specific pressure-nerves. The latter terminate in certain points of the skin which are not only especially sensitive to very delicate contact, but contain also peculiar organs which excite a granular sensation on pressure. The pressure-points are arranged after the same fashion as the temperature-points, but are in general much more closely aggregated. Both they and the temperature-points supply us with information in regard to locality.

— Any one may become a member of the Roman alphabet association, to which reference is made in the article in this number on 'The intellectual movement in Japan,' by the payment of an annual fee of one dollar. All donations should be addressed to Roma-ji-kai, Tokio, Japan.

— The dredging-machinery for the excavation of the Panama canal is exceedingly powerful. One of the dredges excavates 3,300 cubic metres per day, and there are two others which excavate 800 and 1,000 cubic metres. Besides these, there are a number of smaller ones in operation, in all, capable of excavating 37,000 cubic metres per day. It is reported that during the month of February, upwards of 1,100,000 cubic metres were excavated.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On a geodetic survey of the United States.

I HAVE been often asked why a geodetic survey and triangulation is the only mode of surveying a large area with precision, and why such slow and tedious methods are requisite for needful accuracy. This paper is an attempt to show, in popular language, both the processes themselves and their necessity; as also why congress should act upon the repeated recommendations of the national academy, and carry out its views.

To many of the habitual readers of *Science*, this letter will appear to deal with elementary matters which they may be assumed to know. To another large and equally earnest class of readers, it may convey useful information. Possibly it may help forward the end sought for; and to this every true lover of science will cry 'God speed.'

Any survey of a small area, as a farm, plantation, or township, may be made by any of the usual methods adopted in ordinary land-surveying, where the area covered by the survey is treated as a plane surface.

The compass and Gunter's chain of sixty-six feet are the usual surveying-instruments in this country. They are liable to serious error. Lack of knowledge of the true local magnetic variation of its secular change from year to year, and of its diurnal change between morning and afternoon, with the always impending possibilities of special local attraction at or near the place surveyed, are among the difficulties attending the use of the compass. The chain stretches with use, and changes its length with the seasons and their varying temperatures, and is often carelessly carried by men little accustomed to precise methods. It is not too much to say that any land worth fifty dollars an acre is too valuable to be surveyed with a compass, and any record of such a survey is likely to become a fruitful source of future litigation. The best of such surveys are but approximations to the truth.

Errors from these approximate measurements are cumulative. When such surveys are extended over large areas, as upon our public lands, serious consequences follow, involving present and future doubt and litigation as to boundaries. This is already apparent in the west. It will become more so in the future as land increases in value.

The necessity for greater precision in original public-land surveys, and for means of ascertaining and checking errors already existing, has been forcibly stated in a report to congress on the survey of the territories, by the National academy of sciences in November, 1878, printed in 'Misc. doc. No. 5, house of representatives, 45th congress, 3d session.' The report of the academy, and the very strong letter of Major J. W. Powell, which forms a part of it, fully describe the character and consequences of the errors alluded to. It also sets forth the true remedy as only to be found in a method of survey which should be as nearly infallible as scientific skill and a laborious and careful application of well-known principles could make it.

This method, as practised for two centuries by civilized nations, consists of a system of triangles, starting from and proceeding toward certain base-lines, measured with every possible care with apparatus specially devised to either entirely eliminate, or to reduce to a minimum, every source of error, whether physical or mechanical, which might vitiate the resulting length of the measured line, or cast a doubt upon its precision.

Apparatus of this nature is now constructed and used, in the U. S. coast and geodetic survey, of such precision that the average probable error of the two primary bases last measured with different apparatus, constructed on different principles, is, roughly, about one twelve-hundred-thousandth part of the lengths of the measured lines.

The exact length of the base being ascertained, and a system of triangles built upon it adapted to and covering the country to be surveyed, the lengths of all the other sides of the triangles in the system are inferred from the familiar theorem that "every triangle has six elements or functions, — viz., three sides and three angles, — any three of which being known (one being a side), the other unknown elements may be computed" with a degree of precision of the same order as that of the known elements.